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The Properties of Brightest Cluster Galaxies in X-Ray Selected Clusters

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Abstract. We present the K-band Hubble diagram for 162 brightest cluster galaxies (BCGs) in X-ray selected clusters, $0.01 < z < 0.83$. The sample incorporates that of Burke, Collins, & Mann (2000) and includes additional infrared data from the 2MASS extended source catalogue. We show that below $z \sim 0.1$ the BCGs show no correlation with their environment, however, above $z \sim 0.1$ BCGs in more X-ray luminous clusters are more uniform in their photometric properties. This suggests that there may be two populations of BCGs which have different evolutionary histories.

1. Introduction

Brightest cluster galaxies (BCGs) provide a unique sample with which to study galaxy evolution in a cluster environment. In a sample of 78 BCGs, $0.05 < z < 0.8$, in X-ray selected clusters, Collins & Mann (1998) and Burke, Collins, & Mann (2000) observed a split with cluster properties in their K-band Hubble diagram. This work substantially increases their sample with 84 BCGs below $z \sim 0.1$ from the *ROSAT* All Sky Survey, with K_s-band data from the 2MASS catalogue. The colour correction between the 2MASS K_s-band and the K-band is negligible (Carpenter 2001) and is henceforth neglected. The 2MASS magnitudes have been checked for consistency against data from the 2m UH telescope. A full discussion of this work will be presented in Brough et al., in preparation.

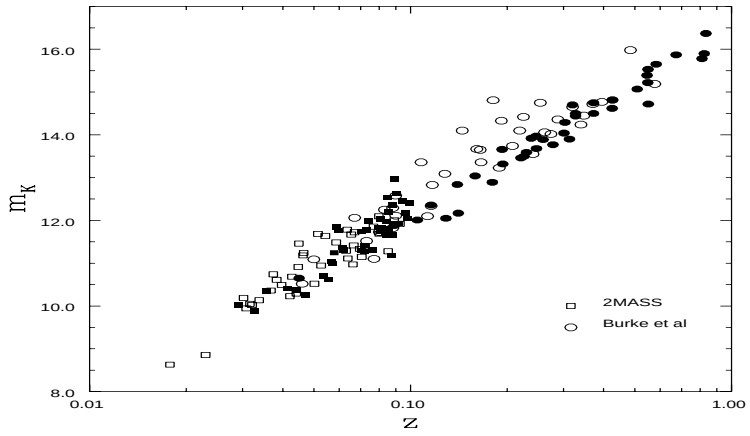

Figure 1. The Hubble diagram. The filled points denote BCGs in clusters with $L_X(0.3-3.5keV) > 2.3 \times 10^{44} ergs^{-1}$

2. Results and Conclusions

Fig. 1 shows the K-band Hubble diagram for 162 BCGs. At redshifts beyond $z >$ 0.1 BCG magnitudes depend on the X-ray luminosity of the host environment, as suggested by Collins & Mann (1998). In particular, clusters with $L_X(0.3-3.5keV) > 2.3 \times 10^{44} ergs^{-1}$ have a scatter of 0.24 mag, compared to those in the low luminosity clusters which have an rms dispersion of 0.5 mag and a Kolmogorov-Smirnov test shows that BCGs in the different environments are different at $>$ 99.9 per cent significance. However, the 97 clusters below z=0.1 indicate that locally BCG magnitudes have a dispersion of 0.3 mag and are uncorrelated with the X-ray luminosity of their host cluster. A KS test shows that they are drawn from the same population at 90 per cent level. These differences suggest that there may be two populations of BCGs with different evolutionary histories: BCGs in less X-ray luminous clusters evolving through a process of mergers and those in more luminous clusters evolving passively. This result has also been seen by Zaritsky et al. in this meeting (astro-ph/0108152).

Acknowledgments

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References

Brough, S. Burke, D.J. Collins, C.A. Lynam, P.D. Mann, R.G. 2001, in prep.

Burke, D.J. Collins, C.A. Mann, R.G. 2000, ApJ, 532, L105

Carpenter, J.M. 2001, AJ, 121, 2851

Collins, C.A. Mann, R.G. 1998, MNRAS, 297, 128